Vatican thinking: There are suggestions that advisers to the Catholic Church may back GM crops. (Picture: Photolibrary.)

for backing GM technology as it offered a means to combating hunger. The document, arising from the meeting sponsored by the academy in 2009, only emerged in the wider public domain last year. Apparently around 40 scientists, including a handful of academy members, met behind closed doors to discuss transgenic plants and food security in the context of development.

The EU's new proposal suggests that pro-GM countries such as Spain and the Netherlands can increase production, while allowing others such as Germany and Austria to maintain restrictions.

And GM crop production is increasing. In 2007, genetically modified maize was grown on a total of nearly 110,000 hectares in Spain, France, Portugal, the Czech Republic and Germany. In the previous year, GM plantings comprised just 62,000 hectares, approximately one per cent of maize cultivation within the EU.

Genetically modified maize — containing a gene from a bacterium that produces a toxin to defend it from the European corn borer (Bt maize) — is the only commercially grown GM crop. The European corn borer is present primarily in southern and central Europe, but is slowly making its way north as new corn breeds make the plants viable in long summer-daylength conditions.

Spain is the leading European country growing Bt maize and accounts for most of the EU's crop. But widespread public opposition in the EU to the introduction of GM crops, as seen in a public demonstration in Brussels last month, is likely to make any expansion difficult and challenging.

Biofuel policies under pressure

The US position on biofuels is criticised but there is still optimism in future potential. **Nigel Williams** reports.

The US has attracted many critics for its policy on biofuels, particularly the use of crops that otherwise could produce food, and does little to combat the emission of greenhouse gases.

The biofuels policy took a hit last month when 17 senators signed a letter calling ethanol 'fiscally indefensible' and 'environmentally unwise'. Led by Democrat Dianne Feinstein and Republican Jon Kyl, the group argued that Congress shouldn't extend certain subsidies that were due to expire at the end of last year, including the 45-cent-per-gallon tax credit for blending ethanol into gasoline and tariffs on cheaper imports.

Conservatives dislike the costly industrial policy, while liberals are against the hefty carbon emissions that come with corn fuels, the *Wall Street Journal* reported. And energy secretary, Steven Chu, told a meeting of the National Press Club last month that "ethanol is not an ideal transportation fuel," and that the government's focus should be on ways "that we can actually go beyond ethanol".

But efforts are under way worldwide to produce ethanol more cheaply and efficiently, and in ways that minimise the impact of carbon emissions. In Denmark, as elsewhere, companies see a big business potential in helping to curb the world's reliance on petrochemicals. Two companies in the country produce 70 per cent of the world's market for enzymes that go into making second-generation ethanol and are collaborating with another company to manufacture a biofuel to be sold across Denmark.

The new fuel blend, which costs about 10 US cents more per gallon than regular fuel, has been sold since last October by around 100 fuel stations.

The new fuel is a blend of petroleum and second-generation ethanol. If the experiment succeeds, it could become part of a business

worth billions of dollars, say energy analysts.

The two companies, Danisco and Novoenzymes, supply enzymes to the producer, Inbicon, which produces ethanol at a plant in western Zealand. Whereas first-generation ethanol is produced from plant products such as corn, wheat and sugar beet that could otherwise be used for food or animal feed, second-generation ethanol is made from agricultural waste materials — straw, husks and leaves — and therefore avoids any food-versus-fuel controversy. Tom Knutzen, Danisco's chief executive, believes developing second-generation ethanol will pay huge business dividends.

The two most common forms of biofuels are biodiesel and ethanol. Biodiesel is made by combining alcohol with vegetable oils or animal fats and recycled cooking oils and remains the fuel of choice in Europe, while ethanol is widely used in the US. As a result, Danisco wants to establish a significant presence in the US market.

The demand for second-generation ethanol is also driving research into more efficient production. Many companies are investing in research and new facilities. And a new report in the *Proceedings of the National Academy of Sciences* (published online) describes a genetically modified yeast cell able to simultaneously ferment both cellobiose and xylose into ethanol.

Suk-Jin Ha at the University of Illinois, Urbana, and colleagues at the University of California, Berkeley and Seoul National University, Korea, describe the need for an efficient means of producing fuel from the plant waste matter, lignocellulose. The use of plant biomass for fuel production will require efficient utilization of the sugars in this material, they say, primarily glucose and xylose. "However, strains of *Saccharomyces cerevisiae* presently ferment glucose but not xylose," they write.

But the researchers describe engineered yeasts that are able to co-ferment mixtures of xylose and cellobiose with improved ethanol yield when compared to fermentation with either cellobiose or xylose as sole carbon sources. "The successful integration of cellobiose and xylose fermentation pathways in yeast is a critical step towards enabling economic biofuel production," they write, as many new approaches to ethanol production are under scrutiny.

Such potential is timely but not enough for the disgruntled senators. "Historically our government has helped a product compete in one of three ways: subsidize it, protect it from competition, or require its use. We understand that ethanol may be the only product receiving all three forms of support from the US government at this time."

Bio-options: US drivers are getting used to ethanol in their fuel and companies believe there is much future in second-generation bio-ethanol production. (Picture: Antoine Lorgnier/Photolibrary.)